Less Than Nothing:
Land Value Taxation When Land Values Are Negative

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Lincoln Institute of Land Policy
Working Paper

Lincoln Institute Product Code: WP12SL1

Abstract

If ownership of land entails holding costs that exceed the land rents that accrue to the property owner, land values can be negative. This analysis considers the conditions under which land values might be negative and demonstrates that negative land values would not fundamentally alter the desirable efficiency characteristics of a land tax. The analysis also provides a framework for determining when external factors that influence property values are attributable to land or building values.

About the Author

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Introduction: Can Land Values Be Negative?

The standard urban model implicitly assumes that land values must be non-negative. In this model, land rents are driven by the demand for proximity to a some central place. Rents – and hence land values – fall the farther a parcel lies from the urban center, but are bounded below by the value of vacant (agricultural) land outside the city.

Consistent with this model, most attempts to estimate land values in developed areas have been developed under the either implicit or explicit assumption that urban land values will be positive. Longhofer and Redfearn (2009), however, developed a technique for estimating land values when vacant lot sales are sparse using single-family residential sales data. In this method, locally-weighted regression results are used to estimate a value surface for a standardized dwelling at each and every transacted parcel in a city. The resulting value surface provides estimates of relative land values across the city: since value is estimated using the same physical structure on each parcel, differences in value are solely attributable to differences in land values. Vacant lot sales on the periphery of the community are then used to "pin down" this land value surface and determine the value of the standardized structure at the periphery of the city. Subtracting this structure value from other estimated values across the city provides estimates of land values throughout the city.

Using this technique on data from Wichita, KS, Longhofer and Redfearn (2009) found that land values in many parts of the city were negative. Although Longhofer and Redfearn were puzzled by these results, further investigation suggested that many of the parcels with negative land values were in neighborhoods that were in severe decline, with poorly maintained homes, significant crime and many abandoned properties, including vacant lots from which blighted structures had been removed. In fact, the City of Wichita will often provide subsidies in order to encourage construction of new homes on these lots, and yet they often sit vacant for years. These circumstances suggest that many of these parcels may, in fact, have negative land values. This issue is likely not unique to Wichita. Especially in the industrial Midwest, many urban areas have seen widespread abandonment of urban properties in the wake of the recent housing downturn. As a result, it is reasonable to expect that land values could be negative in parts of cities all over the United States.

Given the well-known advantages of a land-only tax over a general property tax, it is worth asking whether these properties would change if land values are negative. In this research, I explore the conditions under which land values can be negative and investigate how negative land values would affect the properties of a land tax.

First Principles: Land Values as Residuals

Consider a vacant parcel of ground that might be used for several different purposes. After being developed, the parcel will be able to generate annual rents that depend on the use for which it is developed. Let r_k denote the annual rents the property would command if improved for use k, δ_k the investor's discount rate, and τ the property tax rate based on the property's assessed value; k could denote various possible uses (retail, industrial, office, residential, etc.), as well as alternative densities of development (e.g., a 10,000 square foot single-family house vs. a 2,000 square foot house).

I allow for the possibility that the property is not assessed at its true market value using a parameter θ_k, which represents any tax value different from the property's market value. If $\theta = 0$, then property taxes are based on the property's overall value (land and buildings inclusive). A land tax would be parameterized by $\theta = -B_k$, where B_k is the value of the structure used for use k. Other values of θ would reflect varying misalignments between market and assessed property values.

Finally, I assume there may be some annual cost of holding the property, χ, regardless of whether it generates any rents for the owner. This cost might reflect the cost of lot upkeep (or penalties associated with failing to keep the lot from becoming a public nuisance), environmental liability, or some other costly burden that accrues to the owner of the lot.

In this case, the total value of the property under use k would be

$$V_k = \sum_{t=1}^{\infty} \frac{r_k - \chi - \tau(V_k + \theta_k)}{(1-\delta_k)^t}. \tag{1}$$

Assuming constant property rents and holding costs, this simplifies to a version of the classic valuation model:

$$V_k = \frac{r_k - \chi - \tau\theta_k}{\delta + \tau}. \tag{2}$$

In order to develop the land under this use, the investor must build the appropriate structure at a cost B_k.[1] Based on this, the most a developer intending to develop the site for use k would be willing to pay for the land is

$$L_k = V_k - B_k. \tag{3}$$

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[1] Below I will make a distinction between the construction cost of the structure, *C*, and the value of the structure, *B*. In the present instance these two are equal since it is assumed that this will be the most efficient structure for the land when it is built.

From this expression it is clear that land values are the residual that remains after the other factors of production (in this case the improvements to the property) are paid. Moreover, competition among various possible uses as well as different investors intending the parcel for the same use will ensure that any vacant parcel will be developed according to the use that brings the highest total value to the land; this use is known as the parcel's "highest and best use." Importantly, the parcel's highest and best use determines the value of the land, regardless of the current use. This fact will be of central importance to the analysis, as will be made clear below.

Challenges in Estimating Land Values

This theoretical construct to determine land values is applicable whether the parcel in question is developed or undeveloped.[2] Vacant land values can generally be estimated quite well using comparable sales of similar properties. Moreover, Dye and McMillen (2007) and Rosenthal and Helsley (1994) show that in large urban areas, land values can be estimated by the sale prices of parcels purchased with the intent of tearing down the existing structure to build a new one. For most developed parcels, however, it is only possible to observe sale prices of the land-structure bundle. In other words, it is impossible to observe the land value separately from the value of the structure on the land.

The difficulties associated with separately valuing land and improvements is not simply of theoretical concern. Brunori and Carr (2002) report that local property tax assessor offices nearly always value land and improvements separately, regardless of whether they are required to do so by state law. Bell and Bowman (2006) show that assessor offices use several method to estimate land values, including the residual method suggested by expression (3) above, multiple regression techniques, and an "allocation" method, in which land values are simply estimated as a fixed percentage of overall property value.

Private fee appraisers often must also separately estimate land and building values. The methods they use include the allocation method discussed by Bell and Bowman (2006). It is more common, however, for appraisers to estimate land values using the residual method, so that land values are equal to the overall value of the property less the (depreciated) cost of the improvements.[3]

The residual approach to estimating land values is theoretically appealing. It is also fairly straightforward when the improvements on the land are relatively new, so that their true value is close to their cost of construction. For older structures and those that otherwise

[2] In this analysis, I will assume that an undeveloped parcel is one on which no structure has been built. In reality, there are many stages to the development process, beginning with the extension of roads to the parcel, continuing with the platting of the site, and so forth. For the purposes of a land tax, some have argued that land values should be based on the value of the land absent these pre-structure development steps. To formally separate out improvements *to* the land from improvements *on* the land (structures) would unnecessarily complicate my analysis without altering the central conclusions.

[3] See the Appraisal Institute's *The Appraisal of Real Estate*, 12th Edition, Chapter 13.

might not be worth what they cost to build, estimating structure values can be problematic.

The residual approach to estimating land values is, of course, intimately related to the cost approach in appraisal, in which the value of a property is estimated by adding the land's value to the depreciated value of any structures on the land: $V = L + B$. Key is that B is not the cost of constructing the improvements, but rather the cost of construction less any accrued depreciation, which takes one of three forms.

Physical deterioration is the result of wear and tear on the structure. It is the loss in value due to the fact that the improvements are typically not brand new. This is the most obvious type of depreciation, and is often estimated based on the property's effective age (condition) relative to its useful life.

Functional obsolescence reflects any loss in value due to components or design that do not meet the needs of the current marketplace. For example, single-family homes without a master bedroom suite, or industrial buildings with inadequate ceiling height might suffer from functional obsolescence.

Finally, *external obsolescence* occurs when factors outside the property cause the building to be worth less than the cost of construction. In essence, external obsolescence reflects losses in value due to the fact that the wrong structure is on the site. Because this loss in value is due to the structure, it is properly attributed to the structure and not the land. As an example, imagine that someone developed a two million square foot warehouse building in northwest North Dakota. Although the structure might be state of the art, with no physical deterioration or functional obsolescence, it would still not sell at a price above its construction cost, because there simply is not demand for this much warehouse space in that location. This loss in value, however, does not affect the underlying land value. Instead, the building's value is reduced below its construction cost to reflect this external obsolescence.

Based on these concepts, the value of the structure on a parcel is estimated as

$$B = C - P - F - E, \tag{4}$$

where C is the cost of constructing the improvements new, P is the accrued physical deterioration of the structure, F is any loss in value due to functional obsolescence of the building, and E is the loss in value due to external obsolescence. Using this definition of structure value, land value can be calculated as a residual as shown in (3) above.

A significant limitation of the residual method is that it requires a great deal of information about the structure of the improvements and, as a result, is of limited usefulness for mass appraisal or empirical academic research. In recent years, several analysts have attempted to develop statistical techniques for estimating land values for a large number of parcels at ones. Gloudemans (2000, 2002) and Gloudemans, Handel and Warwa (2002) all attempt to use non-linear regression (hedonic) techniques to estimate land values from improved parcel sales data. Specifically, these papers model total property value as additive in its land and building components but *multiplicative* within the characteristics of each of these components. Because land and building values are separable in this model, it is possible to use the regression coefficients to separately estimate land and building values. Ashley, Plassmann and Tideman (1999) use a quadratic spatial smoothing technique to estimate land values after estimating overall property values using a hedonic regression. Longhofer and Redfearn (2010) use locally weighted regressions to estimate a value surface for a standardized structure across a metropolitan area. By pinning down this value surface at the periphery, they are able to estimate the value of this standardized structure and, hence, the value of the land at every point in the surface.

Decomposing Land and Building Values

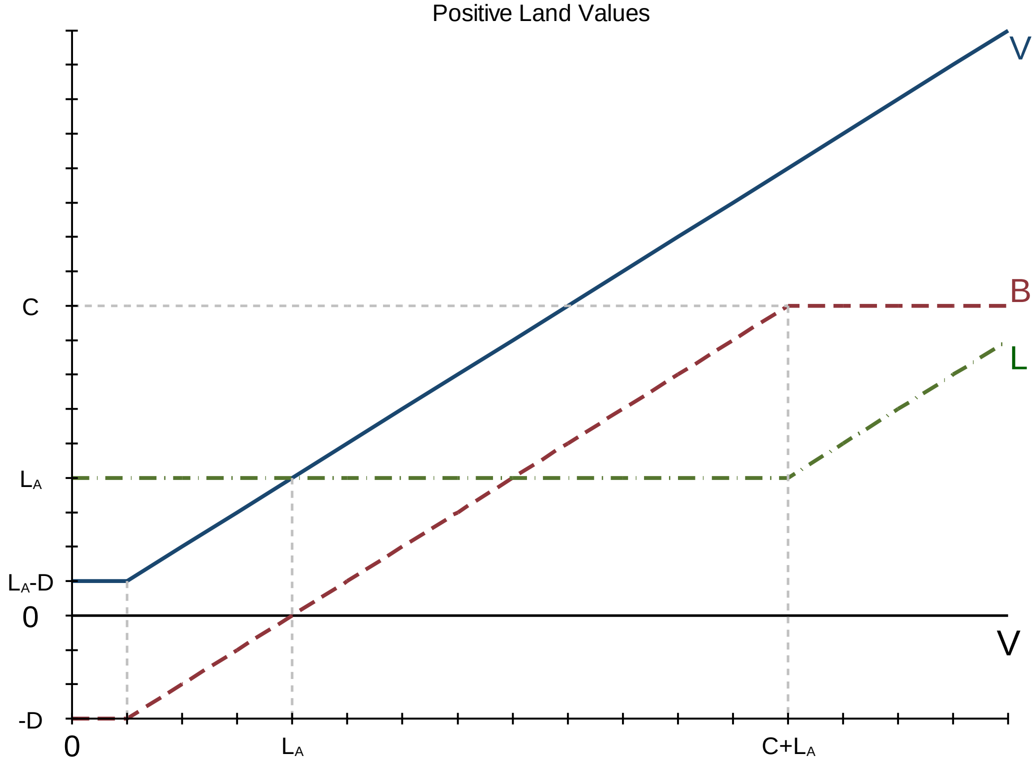
Even when such statistical techniques are used to estimate land values, the concept of land value as a residual is still important for understanding how various factors will influence land and structure values. Suppose a parcel has total market value V and let L_A denote the value of the land under its best alternative use. Assume for simplicity that $P = F = 0$, so that the structure has no physical deterioration or functional obsolescence.[4] Figure 1 depicts various cases and shows how the parcel's land and building values change as the overall value of the property changes.

If the parcel's total value $V \geq C + L_A$, then the structure value is equal to its construction cost ($B = C$) and the land's value is simply $L = V - B$. In this case, $L > L_A$, and the parcel's current use is its highest and best use. As the parcel's total value falls (because, perhaps, overall market rents are lower), the entire value loss is attributable to the land until V falls below $C + L_A$. Once $V < C + L_A$, additional losses in value are attributable to the structure in the form of external obsolescence, E, and $L = L_A$.

Let D denote the cost of demolishing the existing structure, and note that because of these teardown costs, it is feasible for the structure value ($B = C - E$) to be negative; this would be the case if the property's total value fell below its land value ($V < L = L_A$), but not so low as to make teardown economically viable.[5] If, however, the property's total value in its existing use falls below $L_A - D$, teardown becomes feasible. In this instance, the owner of the property would tear down the existing structure to convert it to vacant land for the alternative use. As a result, the property's market value should never fall below $L_A - D$, its value as vacant land for an alternative use less the cost of demolishing the existing structure.

[4] This assumption is completely innocuous; nothing in the analysis would change if P or F were positive. The key point in Figure 1 is the identification of external obsolescence.
[5] Of course, this is even more likely to be the case if the structure suffers from significant physical deterioration and/or functional obsolescence.

Figure 1 - Property Value Composition



Can Land Values Be Negative?

Based on the above discussion, a parcel's land value can be written as

$$L = \max(L_A, V - B). \tag{5}$$

As a result, the parcel's land value can only be negative if it is negative under its best alternative use. Assuming that the property would be developed optimally in its alternative use (so that structure's value under that use is exactly equal to its construction cost, C_A, which could be zero if the optimal use of the land involves no improvements), expression (3) above can be used to express the land value under the alternative use as

$$L_A = V_A - C_A = \frac{r_A - \chi - \tau\theta}{\delta + \tau} - C_A. \tag{6}$$

This expression will be negative if and only if

$$r_A < (\delta + \tau)C_A + \chi + \tau\theta. \quad (7)$$

In other words, the value of the land under its alternative use is negative if the rents the property can generate are less than the after-tax "building rents," plus the holding costs, plus any excess property tax assessment.

Notice that it must be the case that $r_A \geq (\delta + \tau)C_A$, because a structure would only be built under an alternative use if the property's rents were more than enough to compensate the investor for the cost of building the improvements; if no structure built, $C_A = 0$.[6] As a result, expression (7) makes it clear that L_A can only be negative if (1) the holding costs associated with the land are positive ($\chi > 0$); or (2) the assessed value of the property exceeds it true market value ($\theta > 0$). If neither of these conditions is true, L_A will always be non-negative, with the land's value being zero if it is not possible to generate any positive rents from the land if vacant.[7]

Recall that the land's value it its current use is $L = \max(L_A, V - B)$. As a result, expression (7) is a necessary, but not sufficient, condition for land values to be negative. If the current use is the site's highest and best use, the land value could well be positive even when expression (7) holds.

Decomposing Land and Building Values with Negative Land Values

Figure 2 depicts the breakdown of land and building values as the property's total value varies when the value of the land under the best alternative use is negative. Once again, I assume for simplicity that $P = F = 0$, so that the existing structure suffers from no physical deterioration or functional obsolescence.

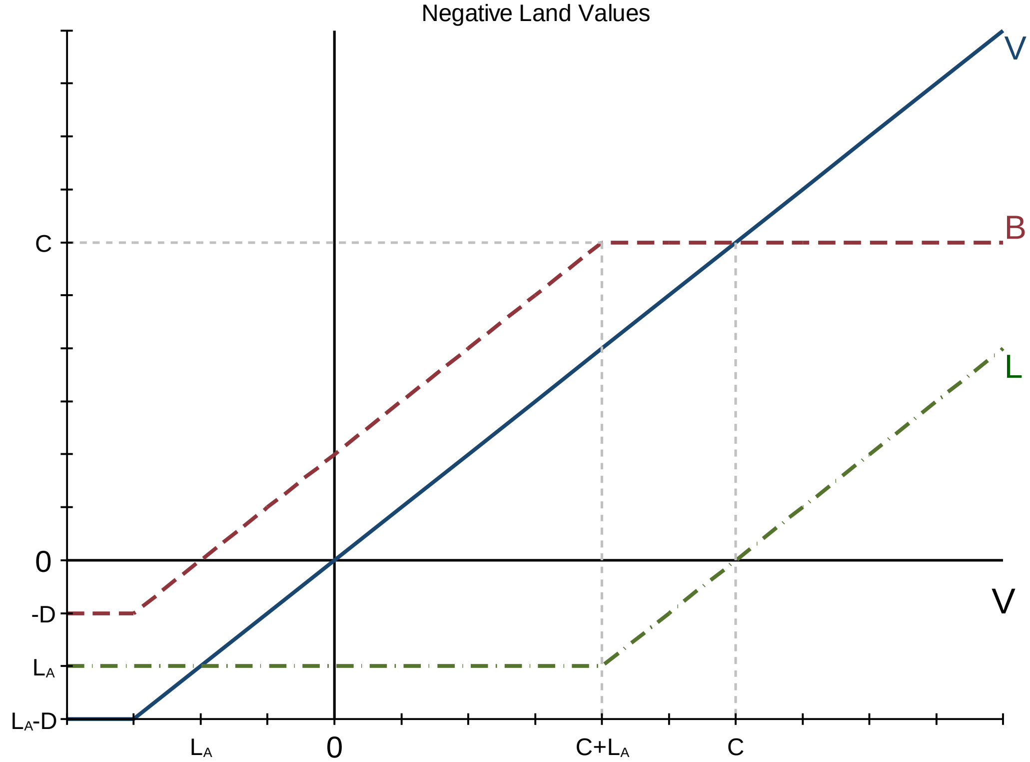
If the property's current value is greater than the cost of its improvements ($V > C$), the land value is positive and any additional increase in the property's value accrues only to the land. If V falls below C, the land's value becomes negative, which is possible because $L_A < 0$. As long as $V > C + L_A$, the property's current use is still its highest and best use, and the land value will be $L = V - C < 0$. When $V < C + L_A$, the highest and best use of the land is the alternative use. In this case, $L = L_A$ and additional value declines are attributable to the structure in the form of external obsolescence.

[6] It is conceivable (although unlikely) that a structure would be built on a property with negative land value. This would be true if the *increase* in the after-tax present value of rents from building the improvement exceeded its construction costs, even though the total rents derived from the property were insufficient to offset the holding and excess taxation costs.

[7] Note that the option to abandon the property does not fully eliminate the possibility of negative land values, since abandoned property becomes the responsibility of the local government, which in turn must bear the holding costs χ.

Figure 2 - Property Value Composition

Negative Land Values



Does a Land Tax Affect the Potential for Negative Land Values?

The next question I address is whether the use of a land-only tax would affect the conditions under which negative land values can occur. Recall that $L = \max(L_A, V - B)$, implying that a parcel's land value can only be negative if its land value is negative under its best alternative use. Assume that $\theta = -C_A$ so that the property tax rate τ is applied only to the value of the land.[8] In this case, expression (6) simplifies to

$$L_A = \frac{r_A - \chi - \delta C_A}{\delta + \tau}. \tag{8}$$

This expression will be negative if

$$r_A < \delta C_A + \chi, \tag{9}$$

[8] Recall that under the alternative use the best possible structure will be built so that $B_A = C_A$.

i.e. if the rents under the alternative use are less than the "building rents" plus the annual holding costs. As before, this is a necessary condition for land values to be negative, but not sufficient.

Comparing this with (7) above, it is clear that a land-only tax reduces the likelihood that land values are negative in two ways. First, it is assumed that there is no excess property tax assessment when a land-tax is implemented. As a result, the final term in (7) does not appear in (9), making the inequality less binding.[9] Second and more importantly, the required "building rents" are lower because the structure is not taxed with a land only-tax, weakening the "negative land value" condition. Nevertheless, the use of a land-only tax only reduces the conditions under which land values are negative, it cannot eliminate them entirely.

Properties of a Land Tax with Negative Land Values

The theoretical benefits of a land tax are well known. It is reasonable to question whether these benefits remain when land values become negative. The short answer to this question is "yes." In this section, I review several of the more prominent benefits associated with a land tax and review how negative land values affect these benefits.

The Land Tax is an Efficient Tax

One of the most notable features of the land tax is that it is an efficient tax, meaning that it raises revenue without distorting private decisions, thereby creating an excess burden. Other than a head tax, nearly every other tax one might conceive alters the decisions of private agents in the economy. More specifically, because taxes drive a wedge between the price paid and the income received from a transaction, the quantity of the good produced/consumed is generally less when the transaction is taxed. This loss of output is known as the deadweight loss or excess burden of the tax. Because the supply of land is perfectly inelastic, however, a land tax has no impact on the amount of land used in the economy. As a result, a land tax entails no deadweight loss. A corollary of this is the result that in a competitive market the incidence of a land tax falls entirely on the owners of the land.[10]

Although I do not formally model the capital investment decision in this analysis, it is straightforward to see that the efficiency of the land tax is not altered when land values can be negative. Irrespective of whether land values are positive or negative, the supply of land is still perfectly inelastic at any particular location. As a result, the presence of the tax does not alter the quantity of the land used and, hence entails no deadweight loss.

[9] Of course, this term would not be present in (7) either if there were no excess property assessment (i.e., if $\theta = 0$). Moreover, this distortion could still exist with a land tax if the assessed land value were not equal its actual value.
[10] See Oates and Schwab (2009) for a more complete exposition of these ideas.

The Land Tax Does Not Distort the Density of Development

A tax levied on the rents (or overall value) of the property as a whole imposes a deadweight cost; although the supply of land is inelastic, the supply of structures that will be built on the land are not. As a consequence, overall property taxes cause land to be developed less intensively than would be the case in their absence.[11] In contrast, a land-only tax has no impact on the density of development. As with the efficiency of the land tax, this basic property is not altered when land values are negative, because the supply of land at any given location is perfectly inelastic.[12]

The Land Tax Does Not Distort the Timing of Development

Another characteristics of the land tax is that it does not alter private decisions as to *when* a parcel of land should be developed, as long as the tax is based on the highest and best use of the parcel and not its current use. Consistent with the arguments above, the fact that the land tax does not alter the marginal development incentives means that it has no distortionary effects. As above, the possibility that land values might be negative does not change this feature of the land tax.

The Land Tax Does Not Distort Redevelopment Incentives

Although the static model in this analysis is not suited to directly demonstrating the land tax properties discussed above, it is possible to analyze how teardown and redevelopment incentives are altered when land values can be negative.

Consider the decision a property owner has regarding demolition of the existing structure and converting the property to an alternative use. As above, let D denote the cost of tearing down the existing structure and V_C denote the value of the property under its current use (where V_C is derived as in (1) and (2) above). An investor will tear down the existing structure and build a new one if

$$L_A = V_A - C_A > V_C + D. \tag{10}$$

This condition states that the property's land value under the alternative use must be greater than its total value in the current use plus the cost of demolishing the existing structure; this is essentially the same condition as that proposed by Rosenthal and Helsley

[11] Mills (1998), building off of Brueckner (1986), demonstrates this effect in a simple model of a monocentric city. Interestingly, Mills' model also suggests that, because the quantity of the good produced at each location is lower with an overall property tax, the overall size of the city will be smaller than it is with a land tax or no tax at all.

[12] In Mills (1998), land rents (and hence values) decline monotonically from the center of the city toward the edge. Thus, it would seem more likely that negative land values might be seen at the edge of his monocentric city. Because the factors that make land values negative (the holding costs χ) are site specific, however, it is conceivable that any site within the city could have negative land values while others around it might be positive. For example, an abandoned underground storage tank on a parcel might cause the value of that parcel (and perhaps those "downstream") to be negative, while others nearby might still be positive.

(1994).[13]

Assuming that the property is assessed at its current market value (so that $\theta = 0$), expression (10) can be rearranged in terms of rents to show that an investor will only renovate if

$$\begin{aligned} \frac{r_A - \chi}{\delta + \tau} - C_A &> \frac{r_C - \chi}{\delta + \tau} + D \\ r_A - r_C &> (\delta + \tau)(D + C_A). \end{aligned} \tag{11}$$

In other words, the investor will tear down and renovate if the increase in rents from the property when redeveloped exceeds the annualized after-tax cost of building the new improvements, including both demolition and construction costs.[14]

Expression (11) makes it clear that the presence of an overall property tax creates a deadweight loss that alters redevelopment incentives. Because the property tax rate τ is positive, it raises the after-tax cost of building the alternative improvements, thereby reducing the incentive of a property owner from converting his land's use. In other words, properties that would be redeveloped in the absence of an overall property tax will not be redeveloped when a property is in place.

Suppose now that the tax is assessed only on the market value of the land. Note that in order for teardown to be a viable option for investor, it must be the case that the land's value is higher under its alternative use so that $L_C = \max(V_C - B_C, L_A) = L_A$. In this case,

$$V_C = \sum_{t=1}^{\infty} \frac{r_C - \chi - \tau L_A}{(1 - \delta_k)^t} = \frac{r_C - \chi - \tau L_A}{\delta}, \tag{12}$$

and, recalling from (8) that $L_A = (r_A - \chi - \delta C_A)/(\delta + \tau)$, the investor will want to tear down the existing structure and redevelop the property if

[13] Note that it is conceivable that the value under the alternative use (and hence its land value) could be negative and yet teardown would still be desirable. For this to be true it must be the case that the annual rents under the alternative use must be less than the costs of holding the property plus any excess property tax payments (i.e., $r_A < \chi + \tau\theta$), and yet still be greater than the rents under the current use plus the after-tax "building rents" associated with tearing down the existing structure and building a new one. Expressed in terms of the parameters of the model, this would required that $\chi + \tau\theta > r_A > r_C + (\delta + \tau)(D + C_A)$.

[14] Because I assumed that the property's holding costs, χ, are unaffected by the property's use, these costs do not affect the redevelopment decision; they are sunk costs from the perspective of the property owner.

$$
\begin{aligned}
L_A &> V_C + D \\
L_A &> \frac{r_c - \chi - \tau L_A}{\delta} + \mathrm{D} \\
\frac{r_c - \chi - \delta C_A}{\delta + \tau} &> \frac{r_c - \chi + \delta D}{\delta + \tau} \\
r_A - r_C &> \delta(D + C_A).
\end{aligned} \tag{13}
$$

Because the tax rate τ does not appear in this expression, it is clear that the land tax is neutral with respect to the redevelopment decision. In other words, the presence of a land tax has no impact on an investor's incentives to tear down an existing structure and replace it with a new one.

How do negative land values affect this feature of the land tax? Once again, the answer is "they don't." First, it is worth noting that in ordinary circumstances, land values will be positive whenever redevelopment is positive. It is conceivable, however, that overall land values might be negative and yet teardown still be optimal, because the net rents from redeveloping are higher than those under the current use. The condition shown in (13), however, holds regardless of the value of the land, so the redevelopment incentives are unaffected by a land tax (even when land values are negative).[15]

Concluding Thoughts

This research has shown that, if property owners bear holding costs or excess tax burdens that exceed the land rents their properties can generate, land values can be negative. This is in contrast to the implicit assumption of the standard urban model, but not in conflict with it, as the excess holding costs posited here are not typically incorporated in the traditional model. The analysis here has shown that the presence of negative land values does not inherently alter the important efficiency characteristics of a land tax.

An important application of this research relates to the estimation of external obsolescence, or the loss in building value due to external factors, in appraisals. Standard techniques for estimating the external obsolescence of a structure often focus of factors that likely affect land, not building, values. This analysis, however, makes it clear that external obsolescence is always a consequence of the wrong building being on the site. In other words, external obsolescence is present only when the current use (either in terms of property type or intensity of development) is not the site's highest and best use.

[15] Two points are worth noting here. First, one might imagine a taxation scheme in which the land tax rate is positive when land values are positive, but reverts to zero when land values are negative (so that no tax subsidy is provided in the event of negative land values). Because the tax rate does not affect redevelopment incentives and the value of the land in the alternative use is beyond the control of the investor, this tax scheme would not alter the basic results. Second, one might question whether a private investor would abandon a property that had negative value instead of redeveloping it. The response to this is that the holding costs that accrue to the property owner would now fall on the local jurisdiction, which would then face the same redevelopment incentives as a private investor. Once again, I conclude that the presence of negative land values does not alter the fact that a land tax does not distort redevelopment incentives.

As long as the current use is the highest and best use of the site, losses in value due to external factors are attributable to the land. Once an alternative use becomes preferable, however, the land's value is determined by this alternative use and additional declines in the property's value are attributed to the building.

One final issue merits some discussion. My original David C. Lincoln Fellowship in Land Value Taxation proposal included a second phase that would use residential sales and property valuation data to identify neighborhoods with negative land values. As it turned out, most of the empirical methods for estimating land values discussed in Section 3 implicitly assume that land values will be positive. As a result, they are generally not well suited to incorporating the possibility that land values could be negative. To explore this further, consider once again the methods for estimating land values discussed in Section 3.

Residual Method

The theoretical issues discussed in this report build directly off of the residual method used by fee appraisers and property tax assessors alike. The fundamental challenge with the residual method involves estimating the depreciation of the structure that reduces its value below its replacement cost. As discussed above, a significant contribution of this research has been to help clarify that external obsolescence – the most difficult type of depreciation to estimate – arises only when the wrong structure is on the property. This analysis, therefore, should help analysts make more accurate estimates of land values using the residual method.

Allocation Method

The allocation method is often used by private fee appraisers and tax assessors to estimate land values. In essence, this method assumes that land values within a community are a fixed positive percentage of the overall property value. As a result, this method precludes the possibility that land values might be negative at all.

Hedonic Regression Techniques

Proposals to use hedonic regression techniques (both linear and non-linear) to estimate land values from improved parcel sales generally assume that certain characteristics of the property affect land values while others affect structure values, and estimate land values using only the shadow prices of the land characteristics. Setting aside the enormous challenges inherent in this exercise (well elucidated by Longhofer and Redfearn, 2009), an analyst would need data regarding the holding costs that cause negative land values in the first place, data that has so far not been present in hedonic value regression datasets. One could imagine that some of these holding costs are fixed across all properties in a locality (either on a per lot or per square foot basis), and hence hedonic land value estimates could be reduced by this fixed amount. Most, however, will be property specific, whether they arise from environmental concerns, physical attributes of the property, or some other locational factor. These factors would need to be identified and the appropriate data collected before hedonic techniques could be expected to reasonably identify properties with negative land values.

In short, only the standardized value surface method proposed by Longhofer and Redfearn (2009), who's negative land value estimated were the motivation for this project, seems particularly well suited to identifying developed parcels that have negative land values.

References

Appraisal Institute, 2001. *The Appraisal of Real Estate,* 12th ed.

Ashley, Richard, Florenz Plassmann and Nicolaus Tideman, 1999. "Improving the Accuracy of Downtown Land Assessment." Lincoln Institute of Land Policy Working Paper WP99RA1.

Bell, Micheal E., and John H. Bowman, 2006. "Methods of Valuing Land for Real Property Taxation: An Examination of Practices in States that Require Separate Valuation of Land and Improvements." Lincoln Institute of Land Policy Working Paper WP06MB1.

Brueckner, Jan K., 1986. "A Modern Analysis of the Effects of Site Value Taxation." *National Tax Journal*, vol. 39, no. 1, pp. 49-58.

Brunori, David and Jennifer Carr, 2002. "Valuing Land and Improvements: State Laws and Local Government Practices." Lincoln Institute of Land Policy Working Paper WP02DB1.

Dye, Richard F. and Daniel P. McMillen, 2007. "Teardowns and Land Values in the Chicago Metropolitan Area." *Journal of Urban Economics*, vol. 61, pp. 45-63.

Gloudemans, Robert J., 2000. "Implementing a Land Value Tax in Urban Residential Communities." Lincoln Institute of Land Policy Working Paper WP00RG1.

Gloudemans, Robert J., 2002. "An Empirical Analysis of the Incidence of Location on Land and Building Values." Lincoln Institute of Land Policy Working Paper WP02RG1.

Gloudemans, Robert J., Sheldon Handel and Michael Warwa, 2002. "An Empirical Evaluation of Alternative Land Valuation Models." Lincoln Institute of Land Policy Working Paper WP02RG2.

Longhofer, Stanley D. and Christian L. Redfearn, 2009. "Estimating Land Values using Residential Sales Data." Lincoln Institute of Land Policy Working Paper WP09SL1.

Mills, Edwin S., 1998. "The Economic Consequences of a Land Tax," in *Land Value Taxation: Can It and Will It Work Today?,* Dick Netzer, editor. Lincoln Institute of Land Policy: Cambridge, MA, pp. 31-48.

Oates, Wallace E. and Robert M. Schwab, 2009. "The Simple Analytics of Land Value Taxation," in *Land Value Taxation: Theory, Evidence, and Practice*, Richard F. Dye and Richard W. England, editors. Lincoln Institute of Land Policy: Cambridge, MA, pp. 51-72.

Rosenthal, Stuart S. and Robert W. Helsley, 1994. "Redevelopment and the Urban Land Price Gradient." *Journal of Urban Economics*, vol. 35, no. 2, pp. 182-200.